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K-type main-sequence star

A **K-type main-sequence star**, also referred to as a **K-type dwarf**, or **orange dwarf**, is a main-sequence (hydrogen-burning) star of spectral type K and luminosity class V. These stars are intermediate in size between red M-type main-sequence stars ("red dwarfs") and yellow/white G-type main-sequence stars. They have masses between 0.6 and 0.9 times the mass of the Sun and surface temperatures between 3,900 and 5,300 K.[1] These stars are of particular interest in the search for extraterrestrial life due to their stability and long lifespan. Well-known examples include Alpha Centauri B (K1 V) and Epsilon Indi (K5 V).[2]

Nomenclature

In modern usage, the names applied to K-type main sequence stars vary. When explicitly defined, late K dwarfs are typically grouped with early to mid-M-class stars as *red dwarfs*,[3] but in other cases *red dwarf* is restricted just to M-class stars.[4][5] In some cases all K stars are included as red dwarfs,[6] and occasionally even earlier stars.[7] The term *orange dwarf* is often applied to early-K stars,[8] but in some cases it is used for all K-type main sequence stars.[9]

Spectral standard stars

The revised Yerkes Atlas system (Johnson & Morgan 1953)[10] listed 12 K-type dwarf spectral standard stars, however not all of these have survived to this day as standards. The "anchor points" of the MK classification system among the K-type main-sequence dwarf stars, i.e. those standard stars that have remain unchanged over the years, are:[11]

- Sigma Draconis (K0 V)
- Epsilon Eridani (K2 V)
- 61 Cygni A (K5 V)

Other primary MK standard stars include:[12]

- 70 Ophiuchi A (K0 V),
- 107 Piscium (K1 V)
- HD 219134 (K3 V)
- TW Piscis Austrini (K4 V)
- HD 120467 (K6 V)
- 61 Cygni B (K7 V)

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Sigma (σ) Draconis, or Alsafi, is a K-type main-sequence star

Characteristics	
Type	Class of medium-small main sequence star
Mass range	$0.6M_{\odot}$ to $0.9M_{\odot}$.
Temperature	3900 K to 5300 K
Average luminosity	Class V

External links

Media category

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Based on the example set in some references (e.g. Johnson & Morgan 1953,[13] Keenan & McNeil 1989[12]), many authors consider the step between K7 V and M0 V to be a single subdivision, and the K8 and K9 classifications are rarely seen. A few examples such as HIP 111288 (K8V) and HIP 3261 (K9V) have been defined and used.[14]

Properties of typical K-type main-sequence stars[1]

Spectral type	Mass ($M_\odot$)	Radius ($R_\odot$)	Luminosity ($L_\odot$)	Effective temperature (K)	Color index (B − V)
K0V	0.88	0.813	0.46	5,270	0.82
K1V	0.86	0.797	0.41	5,170	0.86
K2V	0.82	0.783	0.37	5,100	0.88
K3V	0.78	0.755	0.28	4,830	0.99
K4V	0.73	0.713	0.20	4,600	1.09
K5V	0.70	0.701	0.17	4,440	1.15
K6V	0.69	0.669	0.14	4,300	1.24
K7V	0.64	0.630	0.10	4,100	1.34
K8V	0.62	0.615	0.087	3,990	1.36
K9V	0.59	0.608	0.079	3,930	1.40

Planets

These stars are of particular interest in the search for extraterrestrial life[15] because they are stable on the main sequence for a very long time (17–70 billion years, compared to 10 billion for the Sun).[16] Like M-type stars, they tend to have a very small mass, leading to their extremely long lifespan that offers plenty of time for life to develop on orbiting Earth-like, terrestrial planets.

Some of the nearest K-type stars known to have planets include Epsilon Eridani, HD 192310, Gliese 86, and 54 Piscium.

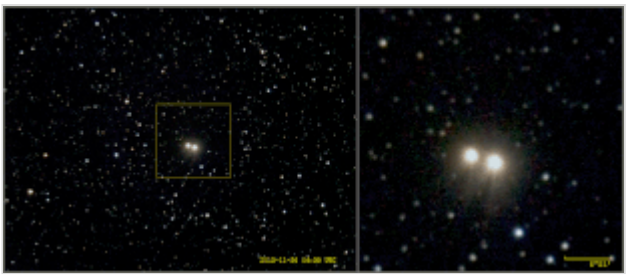
K-type main-sequence stars are about three to four times as abundant as G-type main-sequence stars, making planet searches easier.[17] K-type stars emit less total ultraviolet and other ionizing radiation than G-type stars like the Sun (which can damage DNA and thus hamper the emergence of nucleic acid based life). In fact, many peak in the red.[18]

While M-type stars are the most abundant, they are more likely to have tidally locked planets in habitable-zone orbits and are more prone to producing solar flares and cold spots that would more easily strike nearby rocky planets, potentially making it much harder for life to develop. Due to their greater heat, the habitable zones of K-type stars are also much wider than those of M-type stars. For all of these reasons, they may be the most favorable stars to focus on in the search for exoplanets and extraterrestrial life.

Radiation hazard

Despite K-stars' lower total UV output, in order for their planets to have habitable temperatures, they must orbit much nearer to their K-star hosts, offsetting or reversing any advantage of a lower total UV output. There is also growing evidence that K-type dwarf stars emit dangerously high levels of X-rays and far ultraviolet (FUV) radiation for considerably longer into their early main sequence phase than do either

heavier G-type stars or lighter early M-type dwarf stars.[19] This prolonged radiation saturation period may sterilise, destroy the atmospheres of, or at least delay the emergence of life for Earth-like planets orbiting inside the habitable zones around K-type dwarf stars.[19][20]



61 Cygni, a binary K-type star system

See also

- Solar analog
- Red dwarf
- Yellow dwarf
- Star count, survey of stars

References

1. E. Mamajek (2022-04-16). "A Modern Mean Dwarf Stellar Color and Effective Temperature Sequence" (http://www.pas.rochester.edu/~emamajek/EEM_dwarf_UBVIJHK_colors_Teff.txt). Retrieved 2022-05-14.
2. "Alpha Centauri B" (http://simbad.u-strasbg.fr/simbad/sim-basic?Ident=Alpha+Centauri+B). *SIMBAD*. Centre de données astronomiques de Strasbourg. Retrieved 2019-06-05.
3. Engle, S. G.; Guinan, E. F. (2011). "Red Dwarf Stars: Ages, Rotation, Magnetic Dynamo Activity and the Habitability of Hosted Planets". *9th Pacific Rim Conference on Stellar Astrophysics. Proceedings of a Conference Held at Lijiang*. **451**: 285. arXiv:1111.2872 (https://arxiv.org/abs/1111.2872). Bibcode:2011ASPC..451..285E (https://ui.adsabs.harvard.edu/abs/2011ASPC..451..285E).
4. Heath, Martin J.; Doyle, Laurance R.; Joshi, Manoj M.; Haberle, Robert M. (1999). "Habitability of planets around red dwarf stars" (https://doi.org/10.1023%2FA%3A1006596718708). *Origins of Life and Evolution of the Biosphere*. **29** (4): 405–24. Bibcode:1999OLEB...29..405H (https://ui.adsabs.harvard.edu/abs/1999OLEB...29..405H). doi:10.1023/A:1006596718708 (https://doi.org/10.1023%2FA%3A1006596718708). PMID 10472629 (https://pubmed.ncbi.nlm.nih.gov/10472629). S2CID 12329736 (https://api.semanticscholar.org/CorpusID:12329736).
5. Farihi, J.; Hoard, D. W.; Wachter, S. (2006). "White Dwarf-Red Dwarf Systems Resolved with the Hubble Space Telescope. I. First Results". *The Astrophysical Journal*. **646** (1): 480–492. arXiv:astro-ph/0603747 (https://arxiv.org/abs/astro-ph/0603747). Bibcode:2006ApJ...646..480F (https://ui.adsabs.harvard.edu/abs/2006ApJ...646..480F). doi:10.1086/504683 (https://doi.org/10.1086%2F504683). S2CID 16750158 (https://api.semanticscholar.org/CorpusID:16750158).
6. Pettersen, B. R.; Hawley, S. L. (1989). "A spectroscopic survey of red dwarf flare stars". *Astronomy and Astrophysics*. **217**: 187. Bibcode:1989A&A...217..187P (https://ui.adsabs.harvard.edu/abs/1989A&A...217..187P).
7. Alekseev, I. Yu.; Kozlova, O. V. (2002). "Starspots and active regions on the emission red dwarf star LQ Hydrae" (https://doi.org/10.1051%2F0004-6361%3A20021424). *Astronomy and Astrophysics*. **396**: 203–211. Bibcode:2002A&A...396..203A (https://ui.adsabs.harvard.edu/abs/2002A&A...396..203A). doi:10.1051/0004-6361:20021424 (https://doi.org/10.1051%2F0004-6361%3A20021424).

8. Cuntz, M.; Guinan, E. F. (2016). "About Exobiology: The Case for Dwarf K Stars" (https://doi.org/10.3847%2F0004-637X%2F827%2F1%2F79). *The Astrophysical Journal*. **827** (1): 79. arXiv:1606.09580 (https://arxiv.org/abs/1606.09580). Bibcode:2016ApJ...827...79C (https://ui.adsabs.harvard.edu/abs/2016ApJ...827...79C). doi:10.3847/0004-637X/827/1/79 (https://doi.org/10.3847%2F0004-637X%2F827%2F1%2F79). S2CID 119268294 (https://api.semanticscholar.org/CorpusID:119268294).
9. Stevenson, David S. (2013). "Stellar Evolution Near the Bottom of the Main Sequence". *Under a Crimson Sun*. Astronomers' Universe. pp. 63–103. doi:10.1007/978-1-4614-8133-1_3 (https://doi.org/10.1007%2F978-1-4614-8133-1_3). ISBN 978-1-4614-8132-4.
10. Johnson, H. L.; Morgan, W. W. (1953). "Fundamental stellar photometry for standards of spectral type on the Revised System of the Yerkes Spectral Atlas". *The Astrophysical Journal*. **117**: 313. Bibcode:1953ApJ...117..313J (https://ui.adsabs.harvard.edu/abs/1953ApJ...117..313J). doi:10.1086/145697 (https://doi.org/10.1086%2F145697).
11. Garrison, R. F. (1993). "Anchor Points for the MK System of Spectral Classification". *American Astronomical Society Meeting Abstracts*. **183**. Bibcode:1993AAS...183.1710G (https://ui.adsabs.harvard.edu/abs/1993AAS...183.1710G).
12. Keenan, Philip C.; McNeil, Raymond C. (1989). "The Perkins Catalog of Revised MK Types for the Cooler Stars". *The Astrophysical Journal Supplement Series*. **71**: 245. Bibcode:1989ApJS...71..245K (https://ui.adsabs.harvard.edu/abs/1989ApJS...71..245K). doi:10.1086/191373 (https://doi.org/10.1086%2F191373).
13. Johnson, H. L.; Morgan, W. W. (1953). "Fundamental stellar photometry for standards of spectral type on the Revised System of the Yerkes Spectral Atlas". *The Astrophysical Journal*. **117**: 313. Bibcode:1953ApJ...117..313J (https://ui.adsabs.harvard.edu/abs/1953ApJ...117..313J). doi:10.1086/145697 (https://doi.org/10.1086%2F145697).
14. Pecaut, Mark J.; Mamajek, Eric E. (2013). "Intrinsic Colors, Temperatures, and Bolometric Corrections of Pre-main-sequence Stars". *The Astrophysical Journal Supplement Series*. **208** (1): 9. arXiv:1307.2657 (https://arxiv.org/abs/1307.2657). Bibcode:2013ApJS..208....9P (https://ui.adsabs.harvard.edu/abs/2013ApJS..208....9P). doi:10.1088/0067-0049/208/1/9 (https://doi.org/10.1088%2F0067-0049%2F208%2F1%2F9). S2CID 119308564 (https://api.semanticscholar.org/CorpusID:119308564).
15. Shiga, David (6 May 2009). "Orange stars are just right for life" (https://www.newscientist.com/article/dn17084-orange-stars-are-just-right-for-life/). *New Scientist*. Retrieved 2019-06-05.
16. Steigerwald, Bill (10 March 2019). " "Goldilocks" stars may be "just right" for finding habitable worlds" (https://www.nasa.gov/feature/goddard/2019/k-star-advantage). *nasa.gov* (Press release). NASA Goddard SFC. Retrieved 2022-12-06.
17. "Orange stars are just right for life" (https://www.newscientist.com/article/dn17084-orange-stars-are-just-right-for-life.html). *New Scientist*. 6 May 2009. Retrieved 2019-06-05.
18. Heller, René; Armstrong, John (2014). "Superhabitable worlds". *Astrobiology*. **14** (1): 50–66. arXiv:1401.2392 (https://arxiv.org/abs/1401.2392). Bibcode:2014AsBio..14...50H (https://ui.adsabs.harvard.edu/abs/2014AsBio..14...50H). doi:10.1089/ast.2013.1088 (https://doi.org/10.1089%2Fast.2013.1088). PMID 24380533 (https://pubmed.ncbi.nlm.nih.gov/24380533). S2CID 1824897 (https://api.semanticscholar.org/CorpusID:1824897).
19. Richey-Yowell, Tyler; Shkolnik, Evgenya L.; Loyd, R.O. Parke; et al. (2022-04-26). "HAZMAT. VIII. A spectroscopic analysis of the ultraviolet evolution of K stars: Additional evidence for K dwarf rotational stalling in the first gigayear" (https://doi.org/10.3847%2F1538-4357%2Fac5f48). *The Astrophysical Journal*. American Astronomical Society. **929** (2): 169. arXiv:2203.15237 (https://arxiv.org/abs/2203.15237). Bibcode:2022ApJ...929..169R (https://ui.adsabs.harvard.edu/abs/2022ApJ...929..169R). doi:10.3847/1538-4357/ac5f48 (https://doi.org/10.3847%2F1538-4357%2Fac5f48).

20. Toubet, Georgina (22 April 2022). "What UV radiation from the 'Goldilocks' stars could really mean" (https://www.slashgear.com/841058/what-uv-radiation-from-the-goldilocks-stars-could-really-mean/). *slashgear.com*. Retrieved 2022-05-14.

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